DOCUMENT RESUME

ED 065 630 TM 001 930

TITLE	Pinsetter Mechanic, Automatic (any ind.) 829.281--Technical Report on Standardization of the General Aptitude Test Battery.
INSTITUTION	Manpower Administration (DOL), Washington, D.C. U.S. Training and Employment Service.
REPORT NO	S-284
PUB DATE	Sep 63
NOTE	7p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Aptitude Tests; *Cutting Scores; Evaluation Criteria; Job Applicants; *Job Skills; Mechanical Skills; Norms; Occupational Guidance; *Personnel Evaluation; Test Reliability; Test Validity
IDENTIFIERS	GATB; *General Aptitude Test Battery; Pinsetter Mechanic (Automatic)

ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 065630

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

Personnel Measurement, Development (Employed) 332.324
S-25T

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EDUCATION & WELFARE
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U. S. Employment Service
In Cooperation with
New York State Employment Service

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September 1963

GATB # 2959

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

Universal Electronic Automatic (Cap Axial) 5-25-28V 6-28V

Summary

The General Aptitude Test Battery, B-1001, was administered to a final sample of 83 men employed at various leading alloys. A multiple-hurdle criterion based on classroom ratings and field ratings was used for validation purposes. On the basis of mean scores, standard deviations, correlations with the criteria, job analysis data and their combined selective efficiency, Aptitudes N-Numerical Aptitude, S-Spatial Aptitude and F-Finger Dexterity were selected for inclusion in the final test norms.

GATB Norms for Precision Electronic, Automatic Cap Axial 5-25-28V 6-28V

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
N	CB-1-D CB-1-I	90	N	Part 2 Part 6	85
S	CB-1-F CB-1-H	90	S	Part 3	85
F	CB-1-O CB-1-P	85	F	Part 11 Part 12	80

Effectiveness of Norms

The data in Table IV indicate that only 60 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 81 percent would have been good workers. 93 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 19 percent would have been poor workers.

TECHNICAL REPORT

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of *Pinsetter Mechanic, Automatic (any mfg.) 639.281*

II. Sample

Early in 1963, the Yonkers local office of the New York State Employment Service received an inquiry from the Director of Training of the Bowl-Mor Company regarding the test selection of Pinsetting Machine Mechanic trainees. A plan was devised whereby trainees attending the course given at the manufacturing site of the pinsetting machine (Otis Elevator Company Plant, Yonkers, New York) would be administered the General Aptitude Test Battery at the outset of the course. Approximately ten to fifteen men attended each class, which was of two weeks duration. These men were employees of various independent bowling alleys that had placed orders with the Bowl-Mor Company for new pinsetting equipment. Because the Yonkers location was the only training facility the sample was composed of men from various parts of the country.

The GATB, B-1002A, was administered to 100 men enrolled in the above training course. Of the 100 men tested, 17 were excluded from the final sample because they could not be properly evaluated with regard to on-the-job performance. Therefore, the final sample consists of 83 males employed as *Pinsetter Mechanics, Automatic (any mfg.) 639.281*.

TABLE I

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criteria (r_1 - classroom ratings) (r_2 - field ratings) for Age and Education

N = 83	M	σ	Range	r_1	r_2
Age (years)	37.7	10.4	19-63	-.186	-.145
Education (years)	11.4	1.9	6-18	.290**	.131

**Significant at .01 level

III. Job Description

Job Title: Automatic Pinsetter Mechanic (expired) Code 824.281

Job Summary: Adjusts, repairs and maintains automatic pin-setting machines in a bowling establishment. Performs preventive maintenance duties such as inspecting, adjusting, cleaning and lubricating pin setting machines. Receives report of machine malfunction and performs corrective maintenance duties. Performs incidental clerical duties.

Work Performed: Inspects, adjusts, cleans and lubricates pin setting machines in accordance with manufacturer's maintenance manual instructions for daily, weekly, monthly, quarterly, and annual inspections; runs each machine through complete cycle by actuating control switches and buttons at rear of machine, and observes its operation visually and audibly for indications of malfunction. Inspects working parts and tightens any loose bolts, nuts, and screws. Checks tension of V-belts, timing and drive chains, by observing amount of deflection and adjusting positions of motors or idler sprockets to obtain correct tension.

Examines sweep board for cracks or breaks; inspects pin cable for signs of wear or fraying. Inspects castors to see that they are securely attached to pit plate and turn freely and that roller surfaces are not unduly worn. Replaces badly worn or broken castors. Observes operation of pin lift to make sure that hooks swing freely, chain pins are exactly opposite each other, and that control clutch trip lever lifts correct distance when tripped by pin. Loosens setscrews on hub of trip-arm, and adjusts throw of lever. Examines rack and pinion gears and bevel gears to see that they are properly aligned and do not bind, and that there are no broken or worn teeth.

Unscrews plug on side of speed reducer and adds lubricant if needed to bring oil level up to plug opening. Replaces plug and tightens with wrench. Lifts turntable from spindle and vacuums pit area to remove accumulated dirt. Cleans chutes and runs with cloth and liquid-type household detergent, removing all gummy deposits which could cause a pin to stick in a chute.

Receives report of machine malfunction from mechanic on previous shift, or from floor manager; or discovers need for repair, parts replacement or adjustment during routine check and inspection. Observes and listens to machine cycling to detect any obvious malfunction. Refers to manufacturer's maintenance manual to diagnose probable cause of malfunction and remedial action to be taken. Determines whether trouble is caused by electrical or mechanical defect by first checking all mechanical components for proper adjustments and clearances. Makes needed adjustments and partially disassembles machine to repair or replace broken or worn parts.

Checks power supply, resetting thermal overload switch, if circuit is open. Refers to wiring diagram and manufacturer's maintenance manual or from own knowledge of electrical and machine functions, isolates operating circuit or circuits which powers or controls the particular function. When malfunctioning circuit has been identified, locates defective component or repairs or replaces defective wiring, and solders or crimps connections, as necessary.

Keeps maintenance log for each machine using cumulative record of corrective maintenance as a guide for more specific preventive maintenance. Keeps inventory of spare parts on hand and reorders replacements.

V. Criteria

A. Description of Criteria:

1. Classroom Ratings: During the two week training course conducted by the company, each trainee's performance was observed by his instructor. Upon completion of the course, the workers in each class were placed in rank-order based on their performance on two 2% item multiple-choice classroom examinations and the instructor's classroom observations. These rank-order ratings were converted to linear scores.

2. Field Ratings: At least six months after completion of classroom training, ratings were made by the company's field service experts on the workers in the sample. In their original form, these ratings were written reports. In order to quantify these ratings, they were broken down into three broad categories; excellent, satisfactory and unsatisfactory job performance. Normalized standard scores were computed for each of these categories.

B. Analysis of Criterion Data: The obtained correlation coefficient of .208 for the relationship between the classroom ratings and field ratings supports the contention that these two criteria are measuring different aspects of performance. Since each of these criteria correlated significantly with one or more of the aptitudes measured by the GATB, a multiple-hurdle criterion was established as the final criterion by setting a critical score on each of these criteria. (See paragraph VII for information on dichotomizing of the multiple-hurdle criterion.)

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Intelligence (G) - required to adjust, repair and maintain automatic pinsetting machinery and to locate and correct defects in electrical systems in accordance with wiring diagram and manufacturer's manual.

Spatial Aptitude (S) - required to inspect pinsetting machinery and to observe the operation visually in order to identify malfunctioning.

Form Perception (P) - required to examine sweep board for cracks and breaks and cable for wear or fraying, and to understand electrical diagrams.

Finger Dexterity (F) - required to use special tools and electrical test equipment to adjust, repair and replace parts of electrical systems.

Manual Dexterity (M) - required to use hand tools, such as screw drivers, pliers, hammers and wrenches.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Classroom Ratings Criterion (r_1) and Field Ratings Criterion (r_2) for the Aptitudes of the CATB: 1953

Aptitudes	M	σ	r_1	r_2
G-Intelligence	103.3	13.6	.531**	-.253
V-Verbal Aptitude	100.3	12.8	.410**	-.053
N-Numerical Aptitude	101.7	15.0	.373**	.078
S-Spatial Aptitude	102.5	18.7	.238**	.057
P-Form Perception	97.4	11.4	.129**	-.139
Q-Clerical Perception	97.5	12.6	.386**	.043
K-Motor Coordination	93.9	17.3	.045	-.106
F-Finger Dexterity	97.9	11.0	.278*	.381**
M-Manual Dexterity	100.4	12.6	.132	.104

**Significant at the .01 level
*Significant at the .05 level

C. Selection of Test Forms:

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X			X	X			X	X
Irrelevant									
Relatively High Mean	X		X	X					
Relatively Low Sigma	X	X			X	X			
Significant Correlation with Criterion1	X	X	X	X	X	X		X	
Significant Correlation with Criterion2								X	
Aptitudes to be Considered for Trial Forms	G	V	N	S	P	Q		F	

Trial forms consisting of various combinations of Aptitudes G, V, N, S, P, Q, & F with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that a four-test battery consisting of G-40, S-40, and F-40 had the best selective efficiency.

VII. Validity of Norms

The validity of the norms was determined by computing the Phi Coefficient for the relationship between the test norms and the multiple-hurdle criterion and applying the Chi Square test. (Since 70 percent of the individuals in the experimental sample were placed in the low criterion group on the basis of the field rating criterion, the critical scores on the classroom rating criterion were determined by placing as close as possible to 70 percent of the individuals in the low criterion group on the basis of this criterion alone. Therefore, the two criteria were weighted equally and when used in combination to form a multiple-hurdle criterion resulted in placing 80 percent of the sample in the low criterion group.)

Table IV shows the relationship between test norms consisting of Aptitudes H, S and P with critical scores of 85, 95 and 90, respectively, and the multiple hurdle criterion. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Test Norms for Power Mechanic, Instrument
(Occ 631.281)
(H-85, S-95, P-90)

N = 93	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	45	50
Poor Workers	22	11	33
Total	27	56	83

Phi Coefficient = .592
χ^2 = 23.050
P/2 = .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes H, S and P with minimum scores of 85, 95 and 90, respectively, have been established as B-1002 norms for Power Mechanic, Instrument (Occ 631.281). The equivalent B-1001 norms consist of H-90, S-90 and P-85.

IX. Determination of Occupational Aptitude Pattern

The data for this study met the requirements for incorporating the occupation studied into OAP-2A which is shown in Section II of the Guide to the Use of the General Aptitude Test Battery, January 1962.